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UNCLASSIFIED - INFORMATION ON SOVIET BLOC INTERNATIONAL GEOPHYSICAL COOPERATION - 1960

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INTERNATIONAL GEOPHYSICAL COOPERATION PROGRAM -- SOVIET-BLOC ACTIVITIES

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I. GENERAL

Interdepartmental Committee on the Conduct of the IGY Hails the End of the International Geophysical Year

The International Committee on the Conduct of the International Geophysical Year has issued a communication in celebration of the end of IGY observations; it is addressed to all workers at Soviet scientific stations, observatories, institutions, expeditions and ships engaged in such work.

It praises the achievements of the specialists in each of the fields of IGY scientific endeavor. It mentions the launching of the first artificial earth satellite as the crowning glory of Soviet contributions.

It points out that the work is far from finished -- the data that has been collected must now be subjected to serious scientific study. "The IGY as an international effort has not ended with the period of observations. Much additional effort is required to 'cull the precious metal from the ore' and reap the reward for the labor expended in collecting the raw material."

The message ends:

"Dear comrades! Colleagues! The IGY Committee congratulates you on the successful accomplishment of the observations in the IGY program and calls upon you to exercise equal steadfastness and self-sacrifice in carrying forward the basic period of processing, exploitation and publication of the data of the IGY in order to enrich humanity with new knowledge concerning its mother planet." ("To All Workers...Taking Part in the Conduct of the International Geophysical Year," message inserted in Meteorologiya i Gidrologiya, No 1, January 1960)

II. ROCKETS AND ARTIFICIAL EARTH SATELLITES

The Influence of Free Molecular Flow of a Rarified Gas on the Readings of Rocket Measurements

Of the greatest interest to modern-day physics of high layers of the atmosphere is the interpretation of the readings of instruments in the upper trajectory of a rocket or capsule, that is, at great altitudes where the medium is subject to the laws of free molecular flow.

This article examines the relative movement of a capsule containing instruments in a free molecular flow of rarified gas. Such a capsule, containing various instruments for the measurement of the density of the upper layers of the atmosphere, is a hollow cylinder whose cavity communicates with the outside medium through a number of "windows" evenly situated along its lateral surfaces. In the case at hand these "windows" were narrow slits parallel to the axis of the capsule. The article represents a detailed study of a method for determining the numbers of molecules that enter and leave the cavity through these openings. The author draws the following conclusions from his investigation:

1. In the case of free molecular flow within the cavity of a capsule of the design mentioned, a state of equilibrium is rather quickly (less than 0.05 seconds) established between the number of molecules entering and leaving the cavity.

2. The concentration of molecules in the cavity of the capsule can be quite accurately computed by using the formula supplied in this article; with the assistance of the barometric formula (given in the text) the inner concentration can be tied in with the concentration of molecules in the surrounding medium.

3. The number of molecules entering the aperture of a manometer situated within a capsule of the described type is to all intents and purposes determined by the concentration of molecules inside the cavity and can be found by using formula (27) in the text (not reproduced here).

("The Influence of Parameters of Free Molecular Flow of a Rarified Gas on Instrument Readings During Rocket Measurements of the Density of High Layers of the Atmosphere," by N. G. Belekhova, Izvestiya Akademii Nauk SSSR, Seriya Geofizicheskaya, No 9, 1959, pages 1424-1429)

III. UPPER ATMOSPHERE

First Results of Photographing the Invisible Side of the Moon

Another report has appeared in a Soviet scientific journal relative to the preliminary results from photographing of the far side of the Moon.

The launching of the automatic station (AMS) with the third cosmic rocket on 4 October 1959 accomplished the feat of photographing the reverse side of the Moon. The photography was begun at a distance of 65,200 km from the Moon and the series ended with the AMS 68,400 km away -- approximately on a straight line connecting the Sun and the Moon. The camera used had two lenses and different focal lengths. The program provided for photos to be taken with different exposures. In the course of 40 minutes the reverse side of the Moon was photographed many times. The program enabled the AMS to take photographs of a large part of the reverse side of the Moon and a small part with already known surface features. The presence of these latter features made it far easier to tie in the selenographic features on the two sides of the Moon.

A great number of photographs are now available, taken with the cameras of 200 mm and 500 mm focal distances. Each original negative was first examined by using a special projecting device with optimum magnification. The first negatives to be selected for preliminary research were those that showed the fewest imperfections.

Prints were made from the negatives to safeguard the negatives against damage and thereafter they were consulted only for control purposes.

Many already known features were identified and these features were present on a majority of the photographs. Some of these features as seen by us from the Earth are distorted, especially those in the marginal areas; these include the Southern Sea, Smyth Sea, the Marginal Sea, the Sea of Crises and Humboldt Sea. We now know their true shapes. We also know now that the reverse side of the Moon is predominantly mountainous and that there are few "seas" there of the type on the side facing the Earth. The entire region on the reverse side of the Moon that adjoins its western edge has an albedo intermediate in value between the albedo of the seas and the mountainous regions. In reflecting capacity this region is similar to the region of the Moon situated between the Tycho and Petavius Craters and the Sea of Nectar.

To the south-southeast of the Humboldt Sea is a mountain chain, interrupted in places, with a total length exceeding 2,000 km; it crosses the equator and extends into the Southern Hemisphere. Beyond this mountain range there is a broad continent with high reflecting capacity. This range has been named the Sovetskiy Range.

A crater lake with a diameter of about 300 km has been named the Moscow Sea. In the south this sea ends in a gulf which has been named the Gulf of the Astronauts. Other prominent features have been named. The photographs show numerous small details with varying albedo; the nature of these details, their form and dimensions will be determined after thorough study of the photographs. ("The First Results of Photographing the Invisible Side of the Moon," by N. P. Barabashov, Active Member of the Academy of Sciences of the Ukrainian SSR and Yu. N. Lipskiy, Doklady Akademii Nauk SSR, Vol 129, No 5, 1959, pages 1,000-1,002)

The Primary Source of Currents of Solar Corpuscles

Much effort has been expended in attempts to discover those regions on the Sun's surface which are the source of corpuscular streams. It has been found that one of the sources of solar corpuscles is solar flares of a magnitude greater than 3, but also those of lesser prominence. Geomagnetic disturbances from flares usually begin suddenly. Nevertheless, flares account for only a relatively small number of the geomagnetic disturbances in an 11-year solar cycle. Evidently there is another source of geomagnetic disturbances that begin suddenly -- radio frequency radiating spots of several types.

The maximum number of geomagnetic disturbances over a whole cycle of solar activity is the result of corpuscular flow of a completely different origin. These disturbances, often called M-disturbances, usually begin gradually, have a sharply-expressed 27-day cycle and seasonal variations with two equinoctial maxima. Corpuscular flow causing M-disturbances are especially important in the years preceding minimum solar activity; these disturbances may last 10-12 days, resulting in almost uninterrupted disruption of short-wave radio communication, especially in Arctic Regions. M-disturbances also occur quite frequently in years of maximum solar activity. Disturbances that begin suddenly do not usually have seasonal variations.

These currents of corpuscles creating these disturbances are the principal currents disrupting short-wave communication, causing auroras, etc.

Observations by the author indicate that floculli are the source of approximately radial currents of corpuscles; he found that the passage of flocculi across the apparent center of the solar disk is accompanied after some time by geomagnetic disturbances.

A further development of this problem should include an explanation of the mechanism of emission of corpuscles from the flocculi. Which of three forms of solar activity is basically responsible for the ejection of corpuscles -- floccular radiation, the corona over a flocculus or the local magnetic field of the active region? The author concludes that it is the latter, because activity continues without any visible manifestation after the flocculi or other "optical" forms of solar activity have disappeared. The dipolar magnetic field previously existing in this region is replaced with a unipolar field which is maintained for some time. We may conclude that the emission of corpuscles from the active region is determined by its magnetic field, be it dipolar or unipolar. Perhaps the emission of corpuscles is associated with demagnetization of ionized gas, but for now it is difficult to expand on this possibility. This, to be sure, is not the only possible solution for this problem.

The velocity of the corpuscles is relatively small, on an average about 150-200 km/sec, and does not change with the phase of solar activity. The emission of corpuscles from the flocculi does not depend on the presence of sun spots. This is because the area occupied by a spot and the sphere of action of its magnetic field is usually small in comparison with the area and dimensions of the entire active field (flocculus).

Of great importance is the explanation for the radial ejection of corpuscles from the flocculi. It is possible that the basic factor here is the approximate radiality and linearity of the coronal forms over the flocculi. ("Concerning the Principal Source of Solar Corpuscular Flow" by E. R. Mustel', Corresponding Member of the Academy of Sciences of the USSR, Doklady Akademii Nauk SSSR, Vol 128, No 2, 1959, pages 265-268)

Observations of the Center of the Galaxy by Radio Telescope

In June 1959 the large radio telescope of the Main Astronomical Observatory of the Academy of Sciences of the USSR was used for observations in the center of the Galaxy on a wavelength of λ 33.3 cm. These observations differed from earlier ones in that they were made with a radio telescope of high resolving capacity, permitting investigation of the structure of the source of Sagittarius-A.

The radio telescope records are shown in Figure 1 (not reproduced here). They clearly show the complex structure of the source of Sagittarius-A. It consists of two components. Component No 1 has a half-width of $\varphi_1 \approx 5'$, while component 2 has a half-width of $\varphi_2 \approx 1°25'$. A study of the diagrams and data indicate that the source of Sagittarius-A is in fact situated in the region of the center of the Galaxy.

Sagittarius was also investigated on the large radio telescope on wavelengths of λ 3.2 cm and λ 9.4 cm. All data tend to show that component 1 has a thermal nature while component 2 is nonthermal. ("Observations of the Field of the Spectrum of the Galaxy on a Wavelength of λ 33.3 cm on the large Radio Telescope of the Main Astronomical Observatory," by V. G. Malumyan, Doklady Akademii Nauk SSR, Vol 129, No 5, 1959, pages 1,003-1,004)

Soviet Citizens Ask for Information on Temperature in the Atmosphere

As is common in the Soviet press, a letter to the editor asking for technical or scientific information is answered by an article on the subject of inquiry. Such is the case in the December issue of Izobretatel' i Ratsionalizator in response to questions posed by several individuals in Nikolayev who are interested in the high temperatures prevailing in the upper atmosphere.

The answer, written by V. Arsent'yev, a scientific worker at the "P. K. Shternberg" Astronomical Observatory, reviews the generally known facts concerning the structure of the atmosphere, the temperatures prevailing at various levels, and the methods for measuring these temperatures. This rather brief exposition ends as follows:

"Preliminary data, based on deceleration of sputniks at an altitude of 200 km, show that the temperature there is 900°; at 300 km -- about 1,900°; at 400 km -- approximately 2,700°. These data require additional checking and refinement."

"In conclusion, it is once again necessary to mention that the temperature of the very rarified upper layers of the atmosphere is not temperature as we ordinarily understand the word. It is only a measure of the velocity of movement of gas particles." ("Temperature of the Atmosphere," by V. Arsent'yev, Izobretatel' i Ratsionalizator, No 12, December 1959, page 27)

Leningrad Conference on Actinometry and Physics of the Atmosphere

The conference on Actinometry and Physics of the Atmosphere was held in Leningrad, 28 January to 4 February 1959. It was organized by the Commission of Physics of the Atmosphere, Academy of Sciences USSR, by the Leningrad University, and by the Main Geophysical Observatory in Leningrad. The aim of the conference was to present all Soviet achievements on the subjects and to discuss future planning.

Attending the conference were 325 scientists representing 40 Soviet scientific organizations and foreign guests from Bulgaria, Communist China, Czechoslovakia and Poland.

Reports presented numbered 102.

Detailed research on solar radiation was mostly processed by the Institute of the Physics of the Atmosphere, Moscow, and the Laboratory of the Physics of the Atmosphere at Leningrad University.

The resolutions accepted at the conference may be briefly summarized as follows: An endeavor should be made to standardize research methods and to establish closer cooperation on an international scale; research in "spectral actinometry" and optics of the atmosphere should be broadened and improved; equipment should be modernized; the "atomic" theory of propagation of solar radiation in the upper atmosphere should be more fully exploited and studied.

Research in "actinoclimatology," a term coined by the Russians, is to be pursued. It concerns a new division of dynamic climatology. Work is expected to be conducted on research on the subject and on the reduction of all obtained data to an annual continuity; on the study of variation of the "solar climate" in time and spatial dimensions, and on finding the best standard methods.

The Main Geophysical Observatory which deals with actinometry is located in Voyeykovo, a suburb of Leningrad. Its laboratories are equipped with a quartz Zeiss spectrograph Q-24, with Soviet spectrographs, monochromators, optic bench, photometers, etc.

The next meeting is to be organized by the Lithuanian Institute of Geography and Geology at Vilna in 1960.

A request has been forwarded to the Academy of Sciences USSR to devote a section of the periodical Izvestiya Akademii Nauk, Seriya Geofizicheskaya, to the Physics of the Atmosphere. ("Conference Devoted to Actinometry and Physics of the Atmosphere at Leningrad," by S. Zakrent, Przeglad Geofizyczny, Fourth Year (XII) 1959, No 2, pages 148-150)

IV. METEOROLOGY

A New Approach to the Problem of Airflow Over and Around Hills

The problem of airflow over and around hills is of importance in understanding cloud formation, the genesis of precipitation, and other phenomena and for such practical purposes as aviation. This article studies the problem, assuming an unlimited atmosphere and hills of an arbitrary form. The author extensively develops a series of equations for the solution of the problem. ("Spatial Problem of Airflow Over and Around Hills by a Current Having No Upward Limits," by B. N. Trubnikov, Doklady Akademii Nauk SSR, Vol 129, No 4, 1959, pages 781-784)

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VI. OCEANOGRAPHY

A Scheme for Vertical Biological Zonality in the Ocean

Expeditions made in recent years on the Vityaz', Galatey, Ob', Al'batros, and other research vessels for the investigation of deep-water fauna have forced us to re-examine the schemes of vertical zonality in the oceans that have been proposed in the past, such as that proposed by the American Committee on Marine Ecology and Paleoecology.

In a series of seminars at the biological laboratories of the Academy of Sciences of the USSR there has been detailed discussion relative to the vertical distribution of oceanic, predominantly deep-water fauna. A scheme has been proposed that was drafted after due consideration of earlier arrangements.

Previous schemes have been inadequate, often being based on abiotic factors such as light, temperature and pressure in the ocean -- despite the fact that the vertical distribution of living organisms and their complexes depends on many other factors, in particular, biological and historical ones. It is more correct to devise a scheme based on a direct analysis of the fauna involved, the more so since we now have abundant data concerning the vertical distribution of oceanic fauna. The qualitative composition of fauna changes with depth in "jumps"; this makes it possible to use it for drawing boundaries between the vertical subdivisions; in general, quantitative changes do not make this possible.

The authors explain in some detail their reasoning when drawing up the following table:

TABLE

Region	Plankton Zone	Plankton Subzone	Benthos Zone	Benthos Subzone
Shallow water	I. Surface (epipelagial)-- from 0 to 200 meters		I. Suprelittoral II. Littoral ±0 meters III. Sublittoral -- 0 to 200 meters	
	Transitional horizon -- from 200 to 500-1,000 m		Transitional horizon -- from 200 to 500-1,000 m	

V. SEISMOLOGY

A Small Size Seismic Station

The program for the Apsheron Seismic Expedition of 1957-1960 calls for a study of the seismicity of the Apsheron Peninsula and adjoining islands. Six regional seismic stations are available to the expedition for this purpose.

Due to the nearness of the sea and highly developed industry, the Apsheron Peninsula and its adjoining islands are the sites of many microseisms; this makes difficult the work of seismic stations in the area. Due to the lack of an oscillograph the sites for seismic stations were selected by the method described in the 1956 report of the Geophysical Laboratory. This method proved unsuccessful for the conditions prevailing on the Apsheron Peninsula. As an example we can mention the Karachukhurskaya seismic station. The amplification of the seismograph-galvanometer system here was 2,000-4,000 instead of 20,000-30,000. We could not move the seismic station to the settlement of Zykh due to the high background of interference.

The authors manufactured a small size seismic station in the laboratory. The recording part of this station fits in a box 80 x 35 x 45 cm. With such a station several points can be investigated in one day because there is no need for a shelter and no great preparations are required. The amplification is 8,000. (A few other details of this easily transportable seismic station are provided and the article is accompanied by five figures.) ("A Small Size Seismic Station," by F. S. Suyatanov, Z. Z. Sultanova, S. M. Alieva, Doklady Akademii Nauk Azerbaydzhanskoy SSR, Vol 15, No 12, 1959, Pages 1,123-1,127)

TABLE (continued)

Deep water	II. Deep water — from 500-1,000 m to 6,000 m	1. Upper or bathy-pelagial — from 500-1,000 to 2,000-3,000 m	IV. Bathyal — from 500-1,00 to 2,500-3,000 m	
		2. Lower or abysso-pelagial — from 2,000-3,000 to 6,000 m	Transitional horizon — from 2,500-3,500 m	
	III. Ultra-abyssal — deeper than 6,000 m		V. Abyssal — from 3,000-3,500 to 6,000 m	1. Upper abyssal — from 3,000-3,500 to 4,500 m
				2. Lower abyssal — from 4,500 to 6,000 m
			VI. Ultra-abyssal — deeper than 6,000 m	

("A Scheme for Vertical Biological Zonality in the Ocean," by G. M. Belyayev, Ya. A. Birshtayn, G. Bogorov, N. G. Vinogradova, M. Ye. Vinogradov and L. A. Zenkevich, Doklady Akademii Nauk SSR, Vol 129, No 3, 1959, pages 658-661)

New Data on the Depths of Ocean Trenches

Work on the calculation and analysis of the latest data concerning the maximum depths of ocean trenches has been carried on in recent years at the Institute of Oceanology of the Academy of Sciences of the USSR. This article exploits the results of this work. Use was made of all available published data concerning depths measured by Soviet and foreign expeditions, the still unpublished results of the Soviet expedition on the Vityaz' and some personal communications from foreign scholars.

Just how many oceanic trenches there are is still subject to dispute. At the present time the accepted number is 26, of which 1 is in the Indian Ocean, 4 in the Atlantic and 21 in the Pacific.

The results of former measurements generally show results that are less than the results of recent measurements. This is due to the fact that the individual point measurements of former years were too widely spaced to find the deepest, extremely narrow parts of the trenches.

Latest research with echo sounders has enabled us to find the real bottoms of the trenches and measure maximum depths. In some cases the new measurements give results that are somewhat less than earlier ones. The erroneousness of former measurements may be due to imperfections in the echo sounding method in the early years of its use. The main purpose of this article is to provide a summarized table (not reproduced here) showing the maximum depths of the ocean trenches; this table is the most reliable one that can be drawn up after a critical examination of all available data. ("New Data Concerning the Depths of Oceanic Trenches," by G. B. Udintsev, Doklady Akademii Nauk SSSR, Vol 129, No 3, 1959, pages 666-669)

Bottom Fauna of Abyssal Depths in the Central Polar Basin

The present article is limited to a summing up of the principal results of Arctic research on the composition of abyssal fauna; the most indicative forms of life are listed and an effort is made to set the upper boundary of the abyssal depths of the central polar basin.

The bottom fauna can be divided into three groups. Some are typically abyssal forms, although found in lesser numbers in higher layers of the ocean; others are found in great numbers at abyssal depths but are more characteristic of the upper layers of the ocean; others are a relatively uncommon constituent of bottom fauna. A list of the most important forms is given for each of the three groups. This listing differs from that proposed earlier by Gorbunov.

In respect to the boundary between the abyssal depths and higher layers of the ocean in this region, Gorbunov suggested 1,000 m; data now suggest it should be much lower -- 1,500 to 1,800 m, at least in sectors closely associated with the continental slope. In sectors of the Central Arctic that are distant from the continental slope (such as on the Lomonosov Range), the abyssal fauna are found at a depth of 1,200 cm and less. The presence of abyssal fauna at this shallow depth is associated with a considerable upwelling of deep ocean water.

The lists of fauna prepared for the great depressions on the Atlantic and Pacific sides of the Lomonosov Range are quite similar, but there are some differences. ("Bottom Fauna of Abyssal Depths of the Central Polar Basin," by V. M. Koltun, Doklady Akademii Nauk SSSR, Vol 129, No 3, pages 662-665)

Bottom Structure of the Pacific Near Hokkaido

The Institute of Oceanology of the Academy of Sciences, jointly with the Acoustic Institute of the Academy, have conducted research on the structure of the bottoms of seas and oceans by seismic-acoustic methods.

The Vityaz', on its 28th voyage, accomplished such research in the northwestern part of the Pacific Ocean in a region situated approximately 700 km to the southeast of Hokkaido. This region was selected to get information on the thickness of the sediments and the most important strata of the Earth's crust characterizing the "wall" extending in a northeast-southwest direction along the Kurile-Kamchatka trench. Research was conducted along three profiles transverse to the "wall" at depths of 5,180-5,800 m; the profiles were 110, 70 and 70 km in length respectively. Each profile was investigated twice -- the ship travelling back and forth over the same profile. The method used basically conformed to that used by the Institute of Oceanology in other regions and that used by foreign researchers. The structure of the Earth's crust is shown in Figure 2 (not reproduced here). It shows that the layer of sediments is very shallow (100-510 m), that there is no granite stratum, that there is a basalt layer and vulcanogenic bodies over this basalt layer. ("Results of Seismic-Acoustic Research on the Structure of the Floor of the Pacific Ocean to the Southeast of Hokkaido Island," by G. B. Udintsev, Doklady Akademii Nauk SSSR, Vol 129, No 4, 1959, pages 923-925)

Position and Seasonal Changeability of Frontal Zones in Antarctica

Recently more and more attention in oceanographic literature has been devoted to work concerning periodic processes in the oceans. This work is beginning to form a new trend in oceanology, a logical transition from the study of mean stationary processes to quasiperiodic and nonstationary processes.

This article is devoted to the problem of the position and seasonal shifting of frontal zones in Antarctica.

Frontal zones in the ocean can be defined as regions with maximum vertical velocities directed surfaceward (zone of divergence) and from the surface downward (zone of convergence). For an investigation of the factors governing vertical velocities of flow in the ocean we use equations for motion in a form suitable for the Southern Hemisphere.

A similar approach to the study of vertical velocities of flow in the ocean has already been used by Ioshida, but he did not consider a case involving a zonal wind. The basic equations are suitably expanded in this article to take this factor into account.

The study of frontal zones in Antarctic waters amounts to a study of the space and time characteristics of the tangential force of the wind. The tangential force of the wind at 20°E. was computed on the basis of maps of the mean atmospheric pressure for the three summer months in 1950 and 1951. The tangential force of the wind has two maxima in the region of 55° and 4[illegible]° S. and a minimum in the area of 51° S. This distribution of the tangential force of the wind is characteristic of the entire water zone surrounding the Antarctic continent because it is determined for the whole region by the wind regime that forms as a result of the interaction of the subtropical belt of high pressure, the Subantarctic low in the middle latitudes and the Antarctic high over Antarctica.

There are two atmospheric fronts in the region of Antarctic waters: the polar front situated along the margin of the ice and the subtropical front. The position of these fronts changes considerably in the course of the year. In fall in the Southern Hemisphere they have the most southerly position while in the spring they shift northward. The 990 and 1015 mb isobars are situated farthest north in November and farthest south in May.

An investigation of the field of atmospheric pressure leads to the conclusion that the wind zone in Antarctica, which does not essentially change in structure during the year, experiences a considerable north-south shifting between spring and fall. This enables us to approximate the field of wind force.

The following significant table gives the position of the frontal zones at different seasons:

POSITION OF FRONTAL ZONES AT DIFFERENT SEASONS OF THE YEAR

Degrees	62	55	57.5	54	53.5	53	49.5	49	48.5	45	44.5	40.5
Winter		AD			AK			SAD			STK	
Spring				AD			AK			SAD		STK
Summer		AD			AK			SAD			STK	
Fall	AD		AK			SAD			STK			

AD = Antarctic Divergence; AK = Antarctic Convergence; SAD = Subantarctic Divergence; STK = Subtropical Convergence.

The results of the calculations shown in the Table show that within Antarctic waters (70° - 40° S.) we can define four frontal zones: Antarctic Divergence, Antarctic Convergence, Subantarctic Divergence and Subtropical Convergence. The Subtropical Divergence has not been defined up to now, despite the obvious fact that the presence of two convergences, not separated by a zone of divergence, cannot satisfy the condition of continuity. The Table also shows that the frontal zones experience considerable shifts in the course of the year. The above Table agrees with the limited hydrologic data that we currently have available. ("Position and Seasonal Changeability of Frontal Zones in Antarctica," by Yu. A. Ivanov, Doklady Akademii Nauk SSSR, Vol 129, No 4, 1959, pages 777-780)

VII. ARCTIC AND ANTARCTIC

Isostatic Sagging of the Earth's Crust in Antarctica

Seismic and gravimetric research on the Antarctic continent and near its shores have made it possible to investigate the problem of the influence of the continent's thick ice sheet on the Earth's crust. Seismic soundings have provided the data we need concerning the thickness of the ice sheet. Gravimetric observations have enabled us to solve the problem as to whether this ice load is compensated.

Anomalies of the force of gravity indicate that the continental platform is essentially in isostatic equilibrium. There is reason to believe that Eastern Antarctica, a typical ancient platform, was in a state of isostatic equilibrium before the glaciation which took place in recent geologic time. It is believed that the excessive load created by the ice is for the most part isostatically compensated and the individual anomalous zones are due to variations in the relief of the underlying rock bed. If anomalies are corrected for subglacial topography from data gained by seismic sounding, the mean values of such anomalies will be close to zero for the entire length of a profile between Mirnyy and Pionerskaya.

How complete is isostatic compensation in other regions of Antarctica? Woollard of the University of Wisconsin offers data for a profile between Little America and Byrd; he notes a noncorrespondence between seismic and gravimetric data and explains it by a change in the mean density of the ice due to a number of factors.

Actually we must assume that this noncorrespondence in data is due to the sagging of the Earth's crust under the weight of the ice. Our analysis of the data supplied for Woollard's profile show that the excessive ice load is essentially isostatically compensated. Since the ice load that is situated above sea level is isostatically compensated, this compensation can take place only as a result of the sagging to the earth's crust under the weight of the ice.

If we bear in mind that the load created by the 3-km thickness of ice (mean density 0.9) is approximately equal to the load of a 1-km thickness of rock (mean density about 2.7), we must assume that in the case of the disappearance of the ice load it would be necessary for the rock bed to rise 1 km to establish isostatic equilibrium.

The thickness of the Earth's crust near Mirnyy is about 30 km, while at Komsomol'skaya it is about 40 km. Such a thickness is characteristic of the continental sectors of the Earth's crust. Nevertheless, the Antarctic continent is now to a considerable degree (especially in Western

Antarctica) transformed into an archipelago. The straits separating present-day islands, where rocks are 500-1,000 m below sea level under the 3-km ice layer, constitute ancient low plains and plateaus which are now below sea level due to sinking of the Earth's crust under the weight of the ice.

Inasmuch as the beginning of Antarctic glaciation dates from the middle of the Tertiary, the isostatic equilibrium of the Earth's crust was attained in a period of no more than twenty million years. It is extremely probable that the actual time involved was much less. ("Concerning the Isostatic Sagging of the Earth's Crust in the Antarctic Under the Weight of the Ice Load," by S. A. Ushakov and G. Ye. Lazarev, Doklady Akademii Nauk SSSR, Vol 129, No 4, 1959, pages 785-788)

A New Pamphlet: "Soviet Scientists on the Sixth Continent"

The All-Union Society for the Dissemination of Political and Scientific Knowledge has issued a 32-page pamphlet summing up some of the work that has been accomplished by Soviet scientists in Antarctica in recent years. The publication, of which 38,000 copies have been printed, is intended for popular consumption. Nevertheless, it should be noted that it does not touch on such matters as physical geography, geology, biological research and cartographic work, but instead concentrates on three principal subjects.

The Introduction was written by the reknowned explorer M. M. Somov, Hero of the Soviet Union and Doctor of Geographical Sciences; the chapter on Atmospheric Circulation and Climate in Antarctica is written by G. M. Tauber; that on Geophysical Work by P. K. Sen'ko; the final chapter by L. D. Dolgushin concerns research on the Ice Mantle Covering Antarctica. Somov provides a brief biographical account of the three authors.

Tauber discusses atmospheric processes in Antarctica in the three basic climatic regions that have been delineated: the Central Ice Plateau, the Slopes of the Ice Plateau and the Coastal Zone.

Sen'ko's chapter doubtlessly contains the most valuable material, but nothing that has not been repeatedly treated in the Soviet press during the past year or so.

Dolgushin provides many details concerning the ice cover of the continent and its subglacial topography.

Although concentrating on the three subjects mentioned, this is nevertheless a cursory treatment. There are no maps, diagrams or illustrations and the pamphlet contains no information not already available in English. ("Soviet Scientists on the Sixth Continent," by M. M. Somov, G. M. Tauber, P. K. Sen'ko, and L. D. Dolgushin, "Znaniye" Publishing House, Moscow, 1959, 32 pages)

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